

A NEW VIEW OF THE STRATIGRAPHY OF MARE DEPOSITS IN MARGINIS BASIN. H. Hiesinger and U. Wolf, DLR, Berlin, Germany; R. A. Yingst and J. W. Head, Dept. of Geological Sciences, Brown University, Providence, RI 02912 USA.

Introduction: To model the mechanisms involved in the transport and eruption of lunar magma, it is important to clarify the characteristics common to many lunar eruptions. In an effort to do this, we have chosen to analyze initially the discrete mare patches (ponds) that occur in the adjacent highlands rather than the major contiguous maria. Ponds considered good candidates for estimates of single eruptive episodes [1,2] were found in statistically significant clusters on the lunar limbs and farside. These deposits have been examined and analyzed in terms of area, volume, mode of occurrence, associated features, crustal thickness relationships and composition [3-5]. These studies have yielded first-order estimates of the typical characteristics of a lunar eruptive episode. Use of these estimates in interpreting magma transport models, however, requires placing these ponds within the proper stratigraphic context. As a first step in this process, we have conducted crater-frequency analyses on several deposits within the Marginis basin.

Data and Results: Previous efforts to date mare deposits in Marginis basin [6] relied on photogeologic analysis and yielded an Early Imbrian age (3.85-3.80 Ga; [7]) for 6 deposits or separate flows, and a Late Imbrian age (3.80-3.20 Ga; [7]) for the remaining 8 deposits or flows. Based upon our crater frequency measurements, two of the ponds previously dated as Early Imbrian (pond 1 in crater Joliot and pond 8 in crater Ibn Yunus; Figure 1) have been dated as younger — 3.76 and 3.78 Ga respectively. These dates place these ponds in the Late Imbrian period (Figure 2). One deposit (pond 2 in crater Hubble; Figure 1) has been dated as 3.80 Ga, at the division between the Early and Late Imbrian periods, as seen in Figure 2. In addition, southern Mare Marginis has been subdivided on the basis of age. Region 1 in Figure 1 has been dated at 3.70-3.62 Ga. Region 2 in Figure 1 has been dated at 3.65 Ga, and Region 3 in this figure has been dated at 3.59 Ga.

Based upon these dates, a preliminary sequence of emplacement can be made. First, assuming that their photogeologically determined ages remain in this range when crater counts are made, the Early Imbrian ponds in the far eastern portion of the basin were emplaced (ponds 6 and 7 in Figure 1), possibly contemporaneously with the pond in crater Hubble (pond 2 in Figure 1). Next, the ponds Ibn Yunus (pond 8) and Joliot (pond 1) were emplaced, with crater frequency data showing an age for Joliot between 3.76-3.65 Ga.

Within this time frame, nearby Central Marginis (Region 1 in Figure 1) was emplaced (3.70-3.62 Ga). Closely following this was the emplacement of the pond within crater Goddard (pond 9 in Figure 1), as well as Region 2, the area in Marginis directly south of this crater, both around 3.65 Ga. Finally, eastern Marginis, just south of Ibn Yunus (Region 3 in Figure 1), was emplaced at around 3.59 Ga.

Conclusions: The crater size distribution ages determined here yield a mare emplacement sequence for Marginis basin that is more peaked than previously supposed [6]. The age spread for mare deposits in Marginis is seen to be more similar to that suggested in Smythii basin to the south. Thus, the period of active mare volcanism maybe essentially the same for both basins, with a volumetrically small period in the Early Imbrian, and a much more volumetrically significant period during the Late Imbrian.

The deposits dated in this analysis in this region are all relatively close in age, clustering around 3.80-3.60 Ga. This might thus suggest a continuum of emplacement in the eastern Marginis region, rather than a sequence of discrete mare emplacement episodes. However, there is a period of almost 200 myr between the emplacement of the pond associated with Ibn Yunus and Region 3 in Mare Marginis due south, only 20 km away. This separation distance is similar in scope to that believed to be associated with separate flows within the Grimaldi basin region [8], and suggests either that the source regions have a much longer cooling time than models currently suggest, that source regions are being emptied and then replenished from depth, or that source regions are smaller than previously supposed, and are extremely abundant spatially and through time [1]. Further dating of the ponds in these and other regions will better constrain the sequence of mare emplacement.

References: [1] R. A. Yingst and J. W. Head, *LPSC* 25, 1531, 1994. [2] R. A. Yingst and J. W. Head, *LPSC* 26, 1539, 1995. [3] R. A. Yingst and J. W. Head, *EOS* 77, F449, 1996. [4] H. Hiesinger *et al.*, *LPSC* 27, 545, 1995. [5] R. A. Yingst and J. W. Head, *JGR*, in review. [6] D. Wilhelms and F. El-Baz, *USGS Map I-948*, 1977. [7] D. Wilhelms, *USGS PP-1348*, 302 pp, 1987. [8] R. Greeley, *et al.*, *JGR* 98, 17,183, 1993.

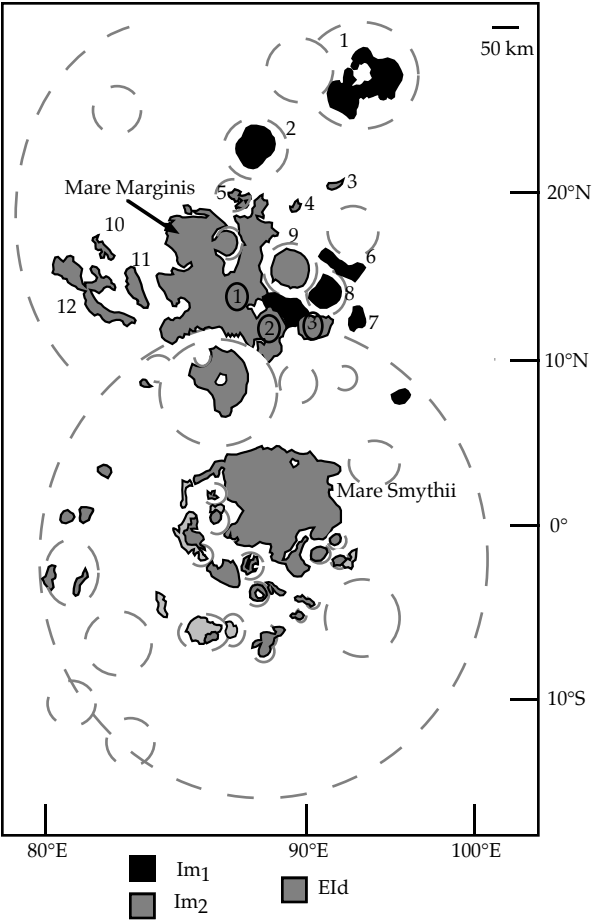


Figure 1. Location map of ponds studied. Ages noted are from [6].

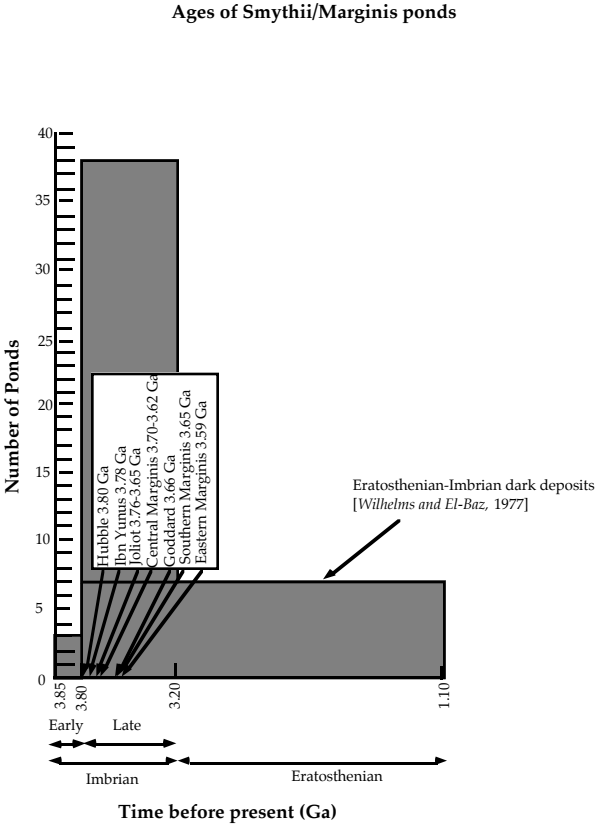


Figure 2. Distribution of pond ages for Smythii-Marginis basins and specific ages (inset) for Marginis ponds examined in this study.